FY 2005 President's Request

Climate Change Research Initiative

Carbon Cycle Atmospheric Measurements

What is requested?

NOAA requests an increase of +$6.5M and 0 FTE to continue implementation of a Carbon Cycle Atmospheric Observing System to determine where carbon dioxide is emitted (sources) and absorbed (sinks) in and around the U.S. The information will reduce uncertainty in prediction of future atmospheric concentrations of carbon, which will help decision-makers gauge the effectiveness of future U.S. carbon emission and sequestration strategies proposed for the National Climate Change Technology Initiative. Prediction of carbon dioxide concentrations in the atmosphere is important because the abundance of this green house gas is a major regulator of climate. The Observing System is part of the North American Carbon Program, which is a cooperative effort between NOAA and its federal partners; in the implementation of Interagency U.S. Carbon Cycle Science Plan, co-sponsored by the National Science Foundation, the National Aeronautics and Space Administration, the Department of Energy, the Department of Agriculture, and the United States Geological Survey are also involved in the interagency plan.

Why do we need it?

Carbon dioxide is the most important excess anthropogenic greenhouse gas implicated in future climate change. Combustion of fossil fuels and deforestation has contributed to a rapid increase in atmospheric concentrations of carbon dioxide over the past 150 years. In addition to causing changes in the Earth's climate system, high levels of carbon dioxide may alter ecological balances through effects on vegetation. Over the last 10-20 years, more than half of the carbon dioxide released by the burning of fossil fuels has been absorbed on land and in the oceans. The efficiency of these carbon sinks changes from year to year and decade to decade, due to a variety of mechanisms only partly understood. Determining the size and variability of this carbon dioxide uptake requires measuring vertical profiles of carbon dioxide over the continents and surrounding ocean basins, as well as optimizing atmospheric transport models. NOAA is the only agency equipped to perform the necessary atmospheric carbon dioxide profile measurements.

The U.S. Carbon Cycle Science Plan highlights the need for research that identifies sources and sinks of carbon dioxide in North America. The Carbon Cycle Atmospheric Observing System responds to this need, combining field observations, modeling, and data assimilation to test and build the next generation of observational tools. These tools will be used to quantify sources and sinks at regional scales over North America and adjacent ocean basins.

Addresses

NOAA Mission Goal #2

Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond

Carbon Cycle Measurements At-a-Glance

What: +$6.5M increase

Why: Understanding the carbon cycle is essential for understanding climate change and for effective management of carbon dioxide emissions.

Knowledge of the carbon cycle, especially biological productivity, is essential for effective natural resource management and for maintaining the long-term sustainability of ecological goods and services. Advances in carbon measurement and understanding will support products such as cutting-edge, internally consistent maps of carbon dioxide uptake over North America and adjacent ocean basins, routine projections of carbon sources and sinks into the future, and assessment of carbon management options.

What will we do?

With funding in FY 2003 and FY 2004, a ring of carbon dioxide aircraft stations around the contiguous U.S. and several aircraft and tall tower (about 500 m) stations in the internal U.S. will compliment the existing systems. The aircraft provide measurements above 5 km and collect air samples; the tall towers provide continuous data at several levels up through the atmospheric boundary layer. The aircraft stations along the U.S. border will allow for the determination of carbon dioxide flow across U.S. borders and will thus provide an accounting mechanism of carbon dioxide budgets over the continent. At the internal stations, weekly aircraft profiling will be combined with tall tower continuous measurements to assess the representative value of the sparser aircraft measurements. Stations are located in key regions for carbon dioxide uptake where measurements and research will be done in conjunction with local universities through grant and contract arrangements.

In order to further define North American carbon sources and sinks, in FY 2005 NOAA will continue to expand this observing system using small aircraft and tall towers to profile carbon gases. The expansion will result in two new aircraft profiling sites to be added to the U.S. border, and the remainder of the funds will be used to operate the system (28 profiling sites), analyze the over 30,000 air samples collected each year, and improve inverse models necessary to determine sources and sinks. In addition, the first Vertical Atmospheric Observatory will be established at the NOAA Research Climate Monitoring and Diagnostics Laboratory site at Trinidad Head, California. This will consist of routine aircraft profiling over the Observatory to detect layers of carbon dioxide, carbon monoxide, ozone and aerosols entering the west coast of the U.S., mainly from Asia.

What are the benefits?

The ability to pinpoint sub-regional carbon dioxide sources and sinks in the U.S. has far-reaching implications for emissions information and the effectiveness of carbon sequestration technologies. Determining sources of variability in North American carbon sinks will allow more effective management of US carbon emissions in the future. With input from other agencies, this program will form a foundation for routine spatial carbon "maps" and periodic "State of the Carbon Cycle" reports that will keep scientists and policy-makers abreast of progress in understanding the North American carbon cycle.

For more information:

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FY 2005 Proposed Climate Change Research Initiative Program Components:

- Global Ocean Observing System
- Carbon Cycle Atmospheric Observing System
- Aerosols, Clouds, and Climate Change
- Climate Change Computing Initiative

Office of Oceanic and Atmospheric Research
Climate Observations and Services
Climate Change Research Initiative

NOAA Budget FY 2004 Change
Carbon Cycle Atmospheric Measurements
+$6.5M
($11.1M total)